

# BIOREMEDIATION OF AQUACULTURE AND BIOGAS SIDE STREAMS USING POLYCHAETES (*HEDISTE DIVERSICOLOR*, O.F. MÜLLER, 1776). PART I: GROWTH & MORTALITY

A. Hagemann<sup>1\*</sup>, H. Wang<sup>1,2</sup>, K.I. Reitan<sup>2</sup>, J. Ejlertsson<sup>3</sup>, H. Wollan<sup>4</sup>, A. Handå<sup>1</sup>, A.M. Malzahn<sup>1</sup>

<sup>1</sup> SINTEF Ocean, 7465 Trondheim, Norway. <sup>2</sup> Norwegian University of Science and Technology, Department of Biology, 7491 Trondheim, Norway. <sup>3</sup> Scandinavian Biogas, Linköping, Sweden. <sup>4</sup> Biokraft AS, Trondheim, Norway  
Email: Andreas.Hagemann@sintef.no

## Introduction

"In a world with growing pressures on resources and the environment, the EU has no choice but to go for the transition to a resource-efficient and ultimately regenerative circular economy" (EREP, 2014). Bio industries are especially well suited to spearhead circular principles, as biological processes *per se* rely on recycling and reuse of organic and inorganic compounds. Circular approaches can help making aquaculture operation greener, e.g. by producing high quality feed components rather than harvesting them. Polychaetes are a natural part of the diet of many aquatic animals and contains high levels of sought after biochemicals, such as omega-3-fatty acids and proteins. Further, they are detritivores, making them perfectly suited as recyclers of organic side streams. Sludge from RAS aquaculture is an obvious feed source for aquatic vermiculture, and has been shown to be promising (Bischoff et al., 2009; Pajand et al., 2017). As an alternative, biogas production is on the rise, and the solid digestate after methanogenesis might also pose a promising substrate for worm farming.

## Material & Methods

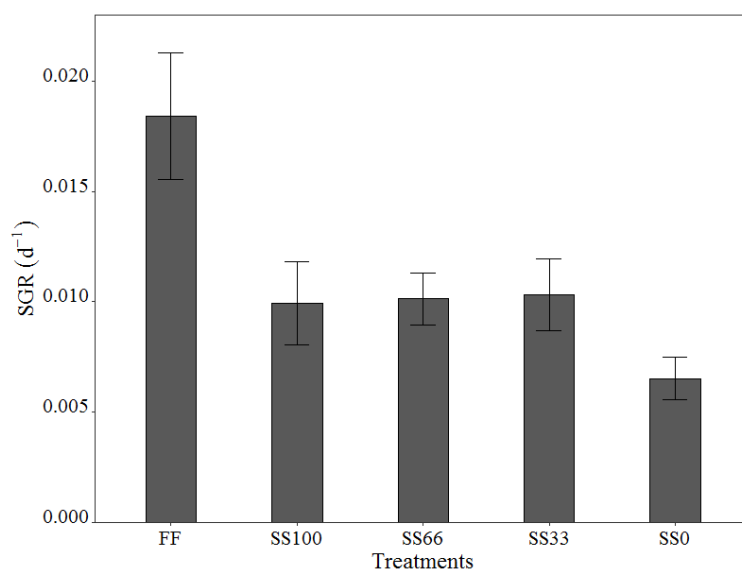
We reared the polychaete *Hediste diversicolor* along a gradient spanning from pure sludge from salmon smolt production to pure solid biogas digestate in 33% steps for 30 days. A group receiving fish feeds served as the positive control. Worms reared on these five different diets were analysed for growth, survival and biochemical composition (cf. part two of this study; Malzahn et al).

## Results

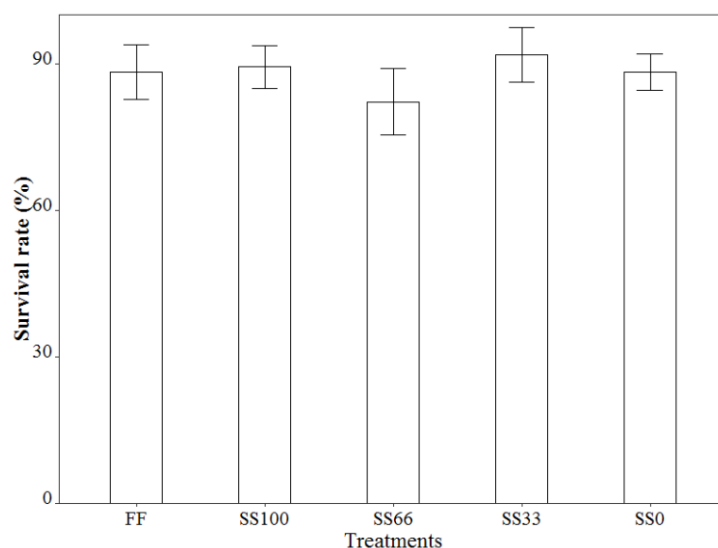
The polychaetes accepted all diets and displayed positive growth. The worms fed FF showed a significantly higher SGR compared to worms produced on the other diets ( $0.018 \pm 0.003 \text{ d}^{-1}$ ;  $p < 0.05$ ), whereas there were no significant differences in SGRs between the other treatments (Fig. 1). Previous studies have shown negative growth for *H. diversicolor* when starved ( $0.02 \pm 0.007 \text{ d}^{-1}$ ). The survival rate ranged from 82 - 92% between the treatments, and there were no significant dietary effects on mortality (Fig. 2).

## Discussion & Conclusion

*H. diversicolor* is a promising candidate to produce high quality feed components from to-date-considered wastes. However, current regulations on an EU level do not allow to use animal products produced on aquaculture and biogas side streams as feed ingredients. Clearly, regulations must be reviewed to unleash the full potential of circular bio production approaches.



**Fig. 1** Specific growth rate (SGR (d<sup>-1</sup>)) of the polychaete *H. diversicolor* in a 30-day cultivation experiment when fed on fish feed (FF), solid biogas digestate (SS0), smolt sludge (SS100) or a 2:1 and 1:2 mixed ratio of smolt sludge and solid biogas digestate (SS66 and SS33, respectively).



**Fig. 2** Final survival (%) of the polychaete *H. diversicolor* in a 30-day cultivation experiment when fed on fish feed (FF), solid biogas digestate (SS0), smolt sludge (SS100) or a 2:1 and 1:2 mixed ratio of smolt sludge and solid biogas digestate (SS66 and SS33, respectively).

## References

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- Pajand, Z.O., Soltani, M., Bahmani, M., Kamali, A., 2017. The role of polychaete *Nereis diversicolor* in bioremediation of wastewater and its growth performance and fatty acid composition in an integrated culture system with *Huso huso* (Linnaeus, 1758). *Aquacult. Res.* 48, 5271-5279.

